Indian Journal of Chemistry
Vol. 39B, June 2000, pp. 475 - 476

Note

Antifeedant activity of the constituents of *Evodia lunu-ankenda*

S G Jagadeesh, G L David Krupadanam &
G Srimannarayana*

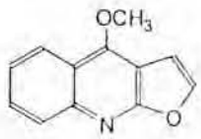
Department of Chemistry, Osmania University,
Hyderabad 500 007, India

Received 20 August 1998; accepted (revised) 10 April 2000

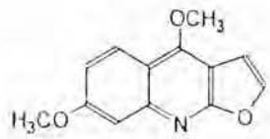
Isolation and structure elucidation of two furoquinoline alkaloids dictamnine **1** and evolitrine **2** from the stem wood of *Evodia lunu- ankenda* by ^{13}C NMR spectral data and insect-antifeedant activity against the agricultural pest tobacco caterpillar IV instar larvae *Spodoptera litura* (F) in non-choice laboratory assay are reported.

In continuation of our work on phytochemical studies of indigenous medicinal[1] and insecticidal[2,3] plants and evaluating their activity encouraged us to carry out chemical examination of *Evodia lunu-ankenda* Geartn[4] (Family Rutaceae) due to their medicinal properties like anti-viral, anti-bacterial, anti-fungal, spasmolytic, CNS active and diuretic[5,6]. An infusion of the leaves and flowers is used in Malaya as tonic and emmenagogue. The plant is also used in fever. A decoction of the root and root bark boiled in oil is given for improving complexion[7]. Dictamnine (4-methoxyfuro [2,3-*b*]quinoline) **1** and evolitrine (4,7-dimethoxy[2,3-*b*]quinoline) **2** were isolated from the bark of *Evodia lunu-ankenda*[8] and also from Rutaceae members such as *Dictamus albus*[9], *Evodia littoralis*[10] and *Evodia belahe*[11]. The synthesis of these alkaloids is also reported earlier[12-17]. The ^{13}C NMR spectral data of these compounds has not been reported.

Alkaloid **1** was obtained as light brown 0.3 g, mp 134°C (Lit[10] 134-36°C). From the mass (M^+ at m/z 199) and elemental analysis its molecular formula is determined as $C_{12}H_9O_2N$. Alkaloid **2** was obtained as light yellow crystals 0.22 g, mp 116°C (Lit[10] 116-17°C). From the mass (M^+ at m/z 229) and elemental analysis its molecular formula is determined as $C_{13}H_{11}O_3N$. In the ^{13}C NMR all carbon signals of the alkaloid **1** and **2** have been accounted for the chemical shifts are entirely compatible with a furoquinoline alkaloid type skeleton.



1



2

In the ^{13}C NMR of alkaloid **1**, the furan carbons appeared at δ 142.42 (C-2), 104.68 (C-3), 103.32 (C-3a), 145.53 (C-9a) and quinoline carbons appeared at 156.75 (C-4), 118.63 (C-4a), 163.76 (C-8a), 127.68 (C-5), 122.40 (C-6), 123.64 (C-7) and 129.53 (C-8). The C-4 methoxyl carbon resonated at 58.91 ppm.

In the ^{13}C NMR of alkaloid **2**, the furan carbons appeared at δ 142.38 (C-2), 104.75 (C-3), 102.00 (C-3a), 148.00 (C-9a) and quinoline carbons appeared at 158.00 (C-4), 118.25 (C-4a), 161.00 (C-8a), 123.52 (C-5), 116.58 (C-6), 157.00 (C-7) and 105.97 (C-8). The C-4 methoxyl carbon resonated at 58.84 and C-7 methoxyl carbon resonated at 55.37 ppm.

Alkaloid **2** is isomeric to *pteleine* (4,6-dimethoxy [2,3-*b*] quinoline) (Lit[16] mp 133°C). Both the compounds showed similar ^1H NMR and mass spectral data. However they showed different UV absorption. The UV spectrum of evolitrine **2** now isolated showed absorptions at 245, 307, 318 and 332 nm which is the same as earlier reported[13] for evolitrine and is different from ptelein[16] (UV absorption at 260, 295 and 350 nm).

Compounds **1** and **2** showed moderate insect-antifeedant activity against the agricultural pest tobacco caterpillar IV instar larvae *Spodoptera litura* (F) in non-choice laboratory assay adopting the procedure of Ascher and Rones[18] and Singh and Panth[19].

Experimental Section

5 kg of *Evodia lunu- ankenda* stem wood was collected from Ramphachodavarem forest, East Godavari district, Andhra Pradesh, India in June 1995, and extracted with methanol:methylene chloride (1:1). The decants were filtered and concentrated by vacuum distillation to 16 g of crude extract which was suspended in water, stirred and filtered. The residue (10 g) was dried *in vacuo* and column chromatographed over silica gel (300 g, 100-200 mesh) eluting

with pet. ether-chloroform (1:1). Fractions of each 250-mL were collected. Fractions 14 to 25 yielded 1.0 g light coloured solid, which was further purified by column chromatography and recrystallisation from chloroform to two crystalline compounds **1** and **2**. Proton decoupled ^{13}C NMR spectra were recorded on Varian Gemini 50.3 MHz in $CDCl_3$ using TMS as an internal standard (chemical shifts in δ ppm). Mass spectra were recorded on Hitachi RMU-6L instrument.

The antifeedant activity of the compounds **1** and **2** were assessed on tobacco caterpillar (*Spodoptera litura* F). The tobacco caterpillar were reared on fresh castor leaves (*Ricinus commcunis*) grown in the Osmania University campus at 27°C±1, R H 65+5%., 14:10 (L. D) photoperiod. Freshly molted fourth instar larvae were used in the assays. The assays were conducted as described by Ascher and Rones[18] in arenas constructed from plastic petri dishes (15×90 mm). A circle of moistened filter paper (9 cm dia) was placed on the floor of each arena. Castor leaf disks (2 cm dia) were cut with a cork borer from leaves with well-developed primary leaflets. Treated leaf disks were dipped in 1 mL of 1000 ppm solution of the test compound in acetone. Control leaf disks were dipped in 1 mL of acetone only. Acetone was allowed to evaporate before assays were initiated. 10 treated and 10 untreated control disks were run for each test and each test was replicated three times. In each petri dish one pre-starved fourth instar larvae was placed. Assays began 4-5 hr after the start of the photophase. Arenas were placed in clear plastic ventilated crisper boxes containing moist paper toweling and placed in an environmental chambers at 27±1°C. The time period of the experiment was 24 hr. Leaf consumption was measured with the help of planimeter and the percentage of protection was calculated using the following formula adopting the method of Singh and Panth[19].

$$\% \text{ Of antifeedant activity} = \frac{\% \text{ Protection in treated} - \% \text{ Protection in control}}{100 - \% \text{ Protection in control}} \times 100$$

Compound **1** showed 62%, while **2** showed 67% of antifeedant activity against the agricultural pest tobacco caterpillar IV instar larvae *Spodoptera litura* (F).

Acknowledgement

We thank to Prof. T Rajagopal. Department of Botany, Osmania University, Hyderabad for identifying plant species and also S. Samba Murthy, Department of Zoology, Nizam College, Osmania University for screening antifeedant activity. We thank Special Assistance Program (SAP) of UGC, New Delhi for financial assistance.

References

1 Nagaiah K, David Krupadanam G L & Srimannarayana G, *Fitotherapia*, LXIII, **1992**, 378; Prashanth A & David Krupadanam G L, *Phytochemistry*, 32, **1993**, 484, Prakesh Rao Ch & David Krupadanam G L, *Phytochemistry*, 35, **1994**, 1597.
2 Jagadeesh S G, David Krupadanam G L & Srimannarayana G, Samba Murthy S, Amarjit Kour & Raja S S, *J Agric Food Chem*, 46 (7), **1998**, 2797.
3 Purohit P, Jyotsna D & Srimannarayana G, *Pesticides*, 23, **1989**.
4 Chopra R N, Nayar S L & Chopra I C, *Glossary of Indian Medicinal Plants* (PID, New Delhi), **1956**, p 115.
5 Hussain A, Viramani O P, Popli S P & Misra L N, *Dictionary of Indian Medicinal Plants* (CIMAP. Lucknow), **1992**, p 205.
6 Zhao W, Wolfender J-L, Hostettmann, Rensheny Xu & Qin G, *Phytochemistry*, 47, **1998**, 7.
7 Dhar M L, Dhawan B N, Prasad C R, Rastogi R P, Singh K K & Tandon J S, *Indian J Exptl Biol*, 12, **1974**, 512.
8 Mohan P S, Ramesh M & Shanmugam P, *J Nat Prod*, 48, **1985**, 501.
9 Ashain, Ohta & Inubuse, *Ber dt chem Ges*, 63, **1930**, 2045.
10 Cooke R G & Haynes H F, *Aust J Chem*, 7, **1954**, 273.
11 Rendst J, Das B C, Ricroch M, Kan-Fan C, Pitier P & Polonsky J, *Phytochemistry*, 7, **1968**, 1019.
12 Cooke R G & Haynes H F, *Aust J Chem*, 11, **1958**, 225.
13 Narsimhan N S & Mali R S, *Tetrahedron*, 30, **1974**, 4153.
14 Grundon M F & Mc Corkindle N J, *J Chem Soc*, **1957**, 2177.
15 Rajamanikam P & Shanmugam P, *Indian J Chem*, 26, **1987**, 910.
16 Werny F & Scheuer P J, *Tetrahedron*, 19, **1963**, 1293.
17 Piozzi F, Venturella P & Bellino A, *Organic Preparations Proceedings International*, 3, **1971**, 223.
18 Ascher K R S & Rones G, *Int Pest Control*, 6 (3), **1964**, 6.
19 Singh R P & Panth N C, *Experientia*, 36, **1980**, 552.